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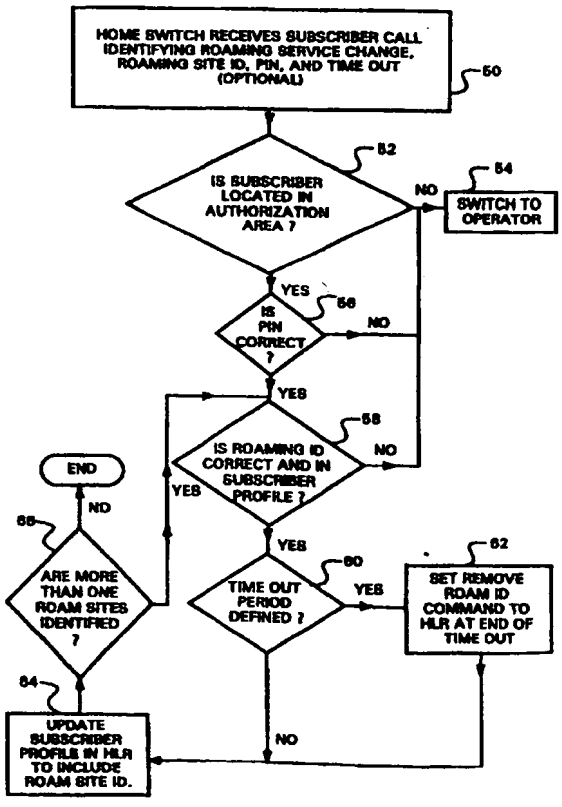
(54) Title: METHOD AND SYSTEM FOR REDUCING FRAUD IN A CELLULAR TELECOMMUNICATIONS SYSTEM

(57) Abstract

There is disclosed a method and a system for reducing fraud in a cellular telecommunications system (10) where subscribers have access to the system in a home switch area (12) and are barred from accessing the system in a roaming area (40). The subscriber through an authentication process is able to identify potential roaming sites where the subscriber intends to be temporarily located. The subscriber first identifies temporary roaming sites (14 and 16) and then roams into these areas. When the subscriber leaves this temporary roaming site, his roaming privileges in this site are terminated. This reduces fraudulent use of the subscriber MIN-ESN numbers when the subscriber is no longer in that roaming cell site of fraudulent use of his identification numbers from other roaming sites in the cellular system.



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METHOD AND SYSTEM FOR REDUCING FRAUD IN A CELLULAR TELECOMMUNICATIONS SYSTEM

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates to a method and system for reducing fraud in a cellular telecommunications system. In particular it relates to a method and system for obtaining subscriber pre-authorization to temporarily access the cellular telecommunications system through a roaming switch.

Description of Related Art

Cellular service providers have faced in recent years a substantial increase in fraudulent use of mobile stations or terminals (MS). This fraudulent use has become particularly cumbersome to combat when a subscriber roams out of his home switch location. Roaming occurs when a mobile subscriber makes a call on a switch other than the usual home switch. This usually means that the subscriber has left the normal city of residence and is now attempting to access the cellular telecommunications system through another service provider's switch or a roaming switch. Roaming is increasingly popular as a means of extending the effective coverage of an individual operator. While the cellular service providers have established roaming agreements between the service providers to allow a subscriber to have automatic roaming privileges, this has led to increased difficulties in policing fraudulent use of mobile telephones.

Detection of roamer fraud is compounded by the fact that the total number of potential roaming customers is extremely large and the size of the overall customer database makes it very difficult to validate roamers. Each mobile subscriber has a mobile identification number (MIN) and an electronic serial number (ESN) through which that subscriber may be identified and validated as a roaming MS by his home location register or home switch database. However, the MIN and ESN information can be easily cloned or duplicated when a valid user transmits a request to register to a mobile switching center (MSC). In particular, when the user has been in a roaming area and later leaves this roaming area, the fraudulent use of the cloned information may continue for a considerable length of time at this roaming switch or another roaming switch. In some instances, the user is not aware of the fraudulent use until receiving an invoice from his cellular service provider. Further it is common practice for the cloned MIN and ESN to be sold to other fraudulent users who access the cellular telecommunication network through other remote roamer switches. For example, MIN and ESN numbers fraudulently obtained in the New York City area might find their way to other switches in the United States such as those in California.

In order to combat fraudulent use of cloned MIN and ESN numbers, many different methods have been employed. In one instance, a master database of all valid and invalid MINs and ESNs is compiled and any roaming MS has to be verified or authenticated by the master database. The problem with this solution is the size of the database has grown into the million of users and is growing very

quickly every year. Accordingly, it is difficult to maintain this database current.

Another example of such a database for detecting fraudulent requests on a roamer cellular system is disclosed in U.S. Patent 5,335,278 which issued on August 2, 1994 to Matchett et al. The method disclosed in this U.S. patent relates to a distributed fraud prevention database memory and processor which is operably associated with each MSC. Each MSC forwards authorized and stolen ESN/MIN numbers to a central database which collects this information and transmits it periodically back to each MSC. The MSC then has local high speed memory devices that check all registering MIN/ESN at call set-up. This system is cumbersome to implement and does not limit or prevent fraudulent use of a cloned ESN/MIN prior to detection. U.S. Patent 5,420,908 issued May 30, 1995 to Hodges et al relates to a method of preventing fraud where ESN and MIN information is transmitted to an authorization platform which in turn engages a response from the MS for authentication information. This is one of many types of methods being developed for the prevention of fraud. However, this method does not reduce the fraudulent use of the cellular telephone during periods when the fraudulent use has not been detected.

Due to increasing revenue losses associated with fraudulent use of MS in roamer switches, cellular providers are restricting services to their home switches and are not allowing subscribers to automatically roam. In order for the subscriber to roam, the subscriber must contact the cellular provider to change the service to allow for roaming privileges. This practice is contrary

to the general direction of cellular providers to allow automatic roaming so that subscribers have extended geographical service areas.

There is a need for providing mobile subscribers with roaming privileges that do not leave the cellular provider open to fraudulent use of the cellular telephone for limited periods of time after the subscriber roaming is completed and which allows the cellular service providers to continue to provide roaming privileges.

SUMMARY OF THE INVENTION

The present invention relates to a method and system for reducing fraud in a cellular telecommunications system. In particular it relates to a method and system for obtaining subscriber pre-authorization to temporarily access the cellular telecommunications system through a roaming area. The present invention provides for the subscriber to automatically contact his service provider and set up temporary roaming authorization in a roaming area. The temporary authorization in the roaming area can end when the subscriber registers in his home area. The temporary authorization can also end when the subscriber terminates the authorization at the home area or after a predetermined period of time has elapsed. This pre-authorization for roaming privileges reduces fraudulent use of the subscribers MIN and ESN information after termination of the roaming authorization.

In accordance with an aspect of the present invention there is provided a fraud reducing system for a cellular telecommunications system where subscribers have access to the system in a home area and are barred from accessing

the system in barred roaming areas. The fraud reducing system comprises a subscriber roaming authorization identifying means in the home area for identifying at least one authorized roaming area through which the subscriber may access the cellular telecommunications system prior to the subscriber registering in the at least one authorized roaming area. The subscriber has means to access to the category to define the identity of the at least one authorized roaming area. The system includes authenticating means located in the home area for authenticating the validity of the subscriber to access its category and define the identity of the at least one authorized roaming area. The system includes registration means located in the barred roaming areas for permitting the subscriber access to the cellular telecommunication system through the barred roaming area provided the barred roaming area corresponds to the authorized roaming area identified in the home area.

It should be understood that home area means a home switch or a group of cellular switches that is serviced by one cellular operator. It should also be understood that authorized roaming area defines a geographical area within which cellular services are provided normally by a foreign or different operator than that in the home area. The authorized roaming area may be identified to include all cells located within one or more switches or selected cells grouped or ungrouped within a selected switch.

The authentication means is preferably included in the home area and includes means for designating a predetermined authorization area for the subscriber. The

authorization area may include one or more switches in the home area. The authentication means includes means in the home area for verifying that the subscriber accesses its roaming authorization category through the authorization area.

The authentication means of the fraud reducing system preferably includes the use of a personal identification number (PIN) that is stored in the subscriber's profile. The authentication means compares the subscriber inputted PIN with a predefined PIN to verify the validity of the subscriber.

Preferably, the fraud reducing system provides for temporary identification of one or more authorized roaming areas. Further there is provided means for removing the identity of the authorized roaming area upon receipt of a registration of the subscriber in its home area. Additionally, the identity of the authorized roaming area may be removed after a predetermined time period has expired, upon receipt of a request to remove the identity of the authorized roaming area by an operator for the home area, or upon receipt of a request to remove the identity of the authorized roaming area by the subscriber.

In accordance with another aspect of the present invention there is provided a method for reducing fraud in a cellular telecommunications system where subscribers have access to the system in a home area and are barred from accessing the system in barred roaming areas. The method comprises the steps of:

identifying in the home area by a subscriber at least one authorized roaming area through which the subscriber desires to access the cellular telecommunications system

prior to registering in the at least one authorized roaming area;

authenticating the validity of the subscriber performing the identification step; and,

registering the subscriber accessing the cellular telecommunication system through one of the barred roaming areas provided the barred roaming area corresponds to the authorized roaming area identified in the home area.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be obtained by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a representation of a cellular telecommunication system and various operators operating within this system;

FIGURE 2 is an embodiment showing roaming and transfer of messages within the cellular system of FIGURE 1;

FIGURE 3 is a flow diagram showing the entry of a roaming site identification area;

FIGURE 4 is a flow diagram showing the processing of a valid roaming request;

FIGURE 5 is a schematic drawing of a portion of subscriber "X" 's user profile in the HLR where visiting roaming areas are temporary defined; and,

FIGURE 6 is a schematic representation of the effect of the subscriber profile of FIGURE 5 on the switching areas.

DETAILED DESCRIPTION OF EMBODIMENTS

Referring to FIGURE 1, there is shown a geographical area 10 for a cellular telecommunication system. This geographical area 10 could represent any area in which a cellular telecommunication system is provided by more than one operator. Within the geographical area 10 operators are shown with coverage areas by operator 12 in full lines and operators 14, 16, 18, and 20 are shown in dotted lines. It should be understood that there maybe more operators operating within the geographical area 10 to provide a more complete coverage of the area, however for the purposes of this description only those operators identified are shown. The home area of operator 12 is shown in block or solid lines to include 4 home switches or mobile switching centers (MSCs) 20, 22, 24, and 26. In MSC 26 of operator 12's home area there is shown a single cell 28 and in MSC 24 of operator 12, there are shown cells 30, 32, and 34 which are grouped into a zone 36. It should be understood that a single cell 28 is shown in one of the MSCs but in that MSC the mapping of typical cell structures in hexagons would probably make for hundreds of cells and micro cells being available. The grouping of cells into zone 36 shown in the other MSC 24 illustrates a zone of cells identified by the operator. For the purposes of this definition, the cells for MSCs shown in area 12 could effectively represent the Metropolitan area of Montreal, Canada, area 14 could represent New York City, area 16 Chicago, area 18 Seattle, and area 20 Dallas. The home area 12 is shown in solid lines because this represents an area in which a subscriber "X" can make and receive calls on a normal

basis due to a service agreement with the operator or service provider of area 12.

It is within this home area 12 that an authorization area is defined for subscriber "X" to make a call to the subscribers home switch and change roaming switch access information. The authorization area may be all MSC's 20, 22, 24 and 26 of home area 12. Alternatively, the authorization area may be restricted to one cell in one MSC, such as cell 28, or a group of cells such as grouping 36. Alternatively the authorization area can be defined as all cells in a given home switch such as MSC 26 of home area 12.

Areas 14, 16, 18, and 20 represent roaming switch areas and are shown in dotted lines to represent the fact that the subscriber is normally barred from registering in these areas to make and receive calls in these areas. While the operator of area 12 may have roaming agreements with operators of areas 14, 16, 18 and 20, the operator 12 prohibits subscriber "X" from roaming.

Referring now to FIGURE 2, there is shown a schematic drawing diagram of the routing between a home area or home switch and a roaming or visiting area. The subscriber at 30 may use his terminal to access through a cell site or base station 32 the home area or gateway MSC 34. The gateway MSC 34 corresponds to any of the areas 20, 22, 24, and 26 of area 12 in FIGURE 1 through which the subscriber is authorized to make a call within the home area. When subscriber 30 is located in an authorized area of area 12, he can change the roaming identification information contained in his user profile so as to temporary access a roaming area. The terminal or user subscriber's 30

profile is stored in the HLR 36 associated with the MSC 34. Normally, when the subscriber 30 is roaming as shown on the upper right hand portion of FIGURE 2 under 30R(R standing for roaming) the terminal 30R accesses through base station 38 a visiting area or roaming area 40. The roaming area checks with its HLR shown as VLR 42 to determine if the subscriber 30R is a valid subscriber in its network. When the visiting area 40 determines that the roaming terminal 30R is not a valid subscriber it then sends a message from VLR 42 to HLR 36 along pathway or route 44. The HLR 36 checks to see if the subscriber 30R has identified the roaming area 40 for roaming purposes. If it has it sends a message back along line or route 46 to VLR 42 to VMSC 40 to permit the registration of roaming 30R. After registration, a call can be placed to the roaming device terminal 30R or from the roaming device terminal 30R to the PSTN network in its home group at 48 or to another cell terminal through routing path 48 between the SSMC and the VMSC. It should be understood that FIGURE 2 represents a GSM type of roaming call establishment and that other methods of establishing a roaming call are available The routing between the HLR 36 and the VLR 42 is usually done by SS7 signaling links. The routing between PSTN 48, the GSMC 34 and the VMSC 40 can be done by any suitable means such as SS7 signaling links.

Referring now to FIGURE 3 the steps involved in registering a user for roaming is described. First, the home area receives from a subscriber a call identifying the routing service change, the routing site ID, the PIN, and the time out options at step 50. This simply may

comprise the subscriber punching into his terminal display a code and number such as, for example, *9*445*7941*072 and pressing the send button to forward this sequence of information to the service provider. The *9 represents the fraud reduction feature code to advise the MSC or the home area that the user or subscriber is requesting a change of the category in its user's profile in the HLR. The *445 represents the temporary service area or roaming site that the subscriber intends to roam in and with respect to FIGURE 1, *445 could identify roaming area 16 for Chicago. The *7941 represents the subscribers PIN. The *072 represents a time out period of 72 hours from this point forward that the subscriber would like to be able to roam in those areas. Of course, it should be understood that the sequence of numbers could continue in an alternate embodiment to include additional roaming sites or areas where the subscriber might be visiting in his travels on a sequential basis and within certain time frames. Such as for example, if the subscriber was going to first go to Chicago in area 16 and then fly to the New York area 14 and then return, he would identify both areas 16 and 14 in sequence and then back to his home area. Also, the time out feature may alternatively include a start time to allow the subscriber to use its home services prior to the start time without terminating the roaming feature.

Next, at step 52 the MSC determines if the subscriber is located within its authorized area. Depending on the service, referring back to FIGURE 1, this could be any cell within any of MSCs 20, 22, 24, and 26 of area 12, it could be defined as one cell such as cell 28 of MSC 26,

or it could be determined to be one or more zones such as zone 36 comprising cells 30, 32, and 34 of MSC 24. In any event, this information would be stored in the user's subscriber profile of the HLR and would be checked by the MSC. If the subscriber was placing his call from an unauthorized area or he was not in his authorized area then the call would be switched to the operator at 54. If the caller calls from the authorized area then the switch checks at step 56 the PIN number. If the PIN does not correspond to the PIN in the switch then the call is sent to the operator at 54. If the PIN is correct, then the switch checks at step 58 if the roaming ID number is correct. This ensures a correct roaming number is identified. If the roaming identification is incorrect, then the call is switched to the operator at 54. If the roaming identification is correct, then the next step 60 occurs. If a time period has been defined at 60, then a remove the roam ID command at 62 is placed into the switch. At the end of the time out, the roam identification number is removed from the subscriber's HLR category thus barring any subsequent calls from this roaming area. Next, at 64, the subscriber's profile in the HLR is updated to include the roam site identification number. At step 66 the switch checks to determine if more than one roam ID site had been identified. If not this process ends. If yes, the process loops back to step 58.

So far, the authorization of the cell site identification has been described. It should be understood that it is not necessary to put a time out feature in step 60, however, such a feature has the advantage of limiting the roaming privilege to the time

the subscriber roams.

Referring to FIGURE 2 and FIGURE 4, the registration of the terminal at 30R is now described. When a request is made for registration by the subscriber 30R in step 68, the MSC determines if the subscriber is part of its home subscribers, or if it is part of a roaming subscriber at step 70. If the subscriber is registering within its home the area checks at step 72 to see if the roam site ID is active in the subscriber's profile. If the roam site is active, then at step 74 the area removes the roam site ID from the subscriber's profile since the subscriber is no longer roaming.

If at step 70 it is determined the subscriber is roaming, then at step 78 messages between the VLR42 (FIG 2) and HLR 36 are transmitted to see if the roaming feature is active. If the answer to this is no, then at step 80 registration is barred and the call is transferred to the operator. If the roaming feature is active, then a determination is made at step 82 as to whether the roam ID stored in the HLR corresponds to the roam area ID of the area registering the roaming subscriber. If the roam ID's do not correspond then the call or registration is barred and transferred to the operator. If the roam ID's correspond then registration of the roaming subscriber is completed at 84.

Referring to FIGURE 5 there is shown an HLR subscribers profile for subscriber "X". In referring to figure 2, the HLR 36 is shown. This subscriber profile would be stored within the data base provided within the HLR 36. Two categories .AA and .TSA are provided in the subscribers user profile for subscriber "X". It should

be understood that these are two of several categories that may be provided in the subscribers user profile that have not been shown in FIGURE 5. For example these other profiles may include system name greeting, call waiting, IN services. The AA represents the authorized areas as defined in the subscriber profile. For the purposes of this illustrated example, the authorized area has been shown to included all the switches MSC 20, MSC 22, MSC 24, and MSC 26 of FIGURE 1. The TSA represents a temporary service area or an area in which the user or subscriber may temporarily roam. For the purposes of this illustration MSC 14 and MSC 16 of FIGURE 1 have been defined as temporary service areas.

Referring to FIGURE 6 there is shown the same MSCs in a circular fashion and numbered the same as the MSCs that were shown in FIGURE 1. MSCs 20, 22, 24 and 26 have been shown with the letters AA contained therein which indicate that these MSCs are authorized areas for subscriber "X". Within this authorized area subscriber "X" may have normal service provided and may also access his home HLR to identify therein the temporary service areas (TSAs) within which he may which to receive roaming privileges. In FIGURE 6 the TSA's are defined for MSC 14 and MSC 16. MSC 18 and MSC 20 have no numeral or letter designation contained therein and the user would normally be barred from accessing these switches. It should be understood that throughout the specification reference has been made to identify these temporary service areas or barred roaming areas in the HLR of the home switch. Alternatively, such temporary service areas could be predefined within the HLR so that the user might only have

to phone up and activate them. In this way, instead of being able to activate any of the four roaming switches MSC 14, MSC 16, MSC 18 and MSC 20 of FIGURE 6, the subscriber might only be able to access switches MSC 14 and MSC 16 and almost be permanently barred from switches MSC 18 and MSC 20. Hence the TSA category in the HLR could be used to identify those switches for which the subscriber "X" could gain temporary service in the event subscriber "X" wished to obtain temporary service from those switches.

It should be understood that the present invention provides a mechanism for allowing a subscriber who is normally barred in a foreign jurisdiction to temporarily roam in pre-identified roaming areas. During the time that the subscriber has his identification active in a roaming area, it is still possible for a fraudulent user to pick up his MIN and ESN numbers and make fraudulent calls. However, as soon as the temporary roaming privilege is terminated, the fraudulent calls are not permitted. Furthermore, the present invention prohibits the use of the MIN and ESN numbers outside of the temporary roaming area at all times. This prevents fraudulent roaming or use of the subscriber's terminal MIN and ESN numbers when the subscriber located in its home area or another pre-identified roaming area.

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications

and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

WHAT IS CLAIMED IS:

1. A method for reducing fraud in a cellular telecommunications system where subscribers have access to the system in a home area and are barred from accessing the system in barred roaming areas, the method comprising the steps of:

identifying in the home area by a subscriber at least one authorized roaming area through which the subscriber desires to access the cellular telecommunications system prior to the subscriber registering in said at least one authorized roaming area;

authenticating the validity of the subscriber performing the identification step; and,

registering said subscriber accessing the cellular telecommunication system through one of the barred roaming areas when the barred roaming area corresponds to the authorized roaming area identified in the home area.

2. The method of reducing fraud of claim 1 wherein the step of authenticating includes the steps of:

a) the home area designating a predetermined authorization area for the subscriber within which the subscriber is permitted to identify authorized roaming areas; and,

b) the home area verifying that the identifying step performed by the subscriber is through the authorization area.

3. The method of reducing fraud of claim 2 wherein the identifying step requires that the subscriber include in the communication to the home area a personal

identification number (PIN) and the verifications step verifying that in the home area that the PIN is a correct PIN for the subscriber.

4. The method of reducing fraud of claim 1 wherein the step of identifying the authorized roaming area is a temporary identification.

5. The method of reducing fraud of claim 4 further including the step of removing the identity of the authorized roaming area upon receipt of a registration of the subscriber in its home area.

6. The method of reducing fraud of claim 1 where a plurality of authorized roaming areas are identified in an order in which the subscriber intends to visit the authorized roaming areas.

7. The method of reducing fraud of claim 6 further including the step of removing an authorized roaming area upon the subscriber registering in its next authorized roaming area.

8. The method of reducing fraud of claim 4 further including the step of removing the identity of the authorized roaming area after a predetermined time period has expired.

9. The method of reducing fraud of claim 4 further including the step of removing the identity of the authorized roaming area upon receipt of a request to

remove the identity of the authorized roaming area by an operator for the home area.

10. The method of reducing fraud of claim 4 further including the step of removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by the subscriber.

11. A method for reducing fraud in a cellular telecommunications system where subscribers have access to the system in a home registration area and are barred from accessing the system in barred roaming areas, the method comprising the steps of:

providing a category in the subscriber's user profile in the home registration area for identifying authorized roaming areas through which the subscriber desires to temporarily access the cellular telecommunications system;

identifying in the subscriber's user profile category at least one of said authorized roaming areas through which the subscriber desires to temporarily access the cellular telecommunications system prior to the subscriber registering in said at least one authorized roaming area;

authenticating the identifying step in said home registration area to be a valid request; and,

registering said subscriber accessing the cellular telecommunication system through one of the barred roaming area when the barred roaming area corresponds to the authorized roaming area identified in the subscriber's user profile category.

12. The method of reducing fraud of claim 11 wherein the step of authenticating includes the steps of:

a) the home registration area designating a predetermined authorization area for the subscriber comprising one or more cells in the home registration area, and,

b) the home registration area verifying that the identifying step performed by the subscriber is through an authorized cell in the authorization area.

13. The method of reducing fraud of claim 12 wherein the identifying step requires that the subscriber include in the communication to the home registration area a personal identification number (PIN) and the verifications step verifying that in the home registration area that the PIN is a correct PIN for the subscriber.

14. The method of reducing fraud of claim 11 further including the step of removing the identity of the authorized roaming area upon receipt of a registration of the subscriber in its home registration area.

15. The method of reducing fraud of claim 11 further including the step of removing the identity of the authorized roaming area after a predetermined time period has expired.

16. The method of reducing fraud of claim 11 further including the step of removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by an

operator for the home registration area.

17. The method of reducing fraud of claim 11 further including the step of removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by the subscriber.

18. The method of reducing fraud of claim 11 wherein the home registration area comprises at least one mobile switching centers (MSCs) operated by one operator and wherein the subscriber's user profile is stored in a home location register (HLR) for the operator.

19. A fraud reducing system for a cellular telecommunications system where subscribers have access to the system in a home area and are barred from accessing the system in barred roaming areas, the fraud reducing system comprising:

subscriber roaming authorization identifying means in the home area for identifying at least one authorized roaming area through which the subscriber may access the cellular telecommunications system prior to the subscriber registering in said at least one authorized roaming area, said subscriber having means to access said identifying means to define the identity of said at least one authorized roaming area;

authenticating means located in the home area for authenticating the validity of the subscriber to access the identifying means and define the identity of said at least one authorized roaming area; and,

registration means located in the barred roaming areas for permitting said subscriber access to the cellular telecommunication system through the barred roaming area provided the barred roaming area corresponds to the authorized roaming area identified in the home area.

20. The fraud reducing system of claim 19 wherein authentication means includes the home area means for designating a predetermined authorization area for the subscriber and, means in the home area for verifying that the subscriber accesses the identifying means through said authorization area.

21. The fraud reducing system of claim 19 wherein the subscriber's roaming authorization category includes a personal identification number (PIN) and the authentication means includes storage means for storing a predefined subscriber PIN and the authentication means compares the subscriber inputted PIN in the category with a predefined PIN to verify validity of the subscriber.

22. The fraud reducing system of claim 19 wherein the authorized roaming area is a temporary identification.

23. The fraud reducing system of claim 22 further including means for removing the identity of the authorized roaming area in the identifying means upon receipt of a registration of the subscriber in its home area.

24. The fraud reducing system of claim 22 further including means for removing the identity of the authorized roaming area after a predetermined time period has expired.

25. The fraud reducing system of claim 22 further including means for removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by an operator for the home area.

26. The fraud reducing system of claim 22 further including means for removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by the subscriber.

27. A fraud reducing system for a cellular telecommunications system where subscribers have access to the system in a home registration area and are barred from accessing the system in barred roaming areas, the fraud reducing system comprising:

a subscriber roaming authorization category defined in the subscriber's user profile in the home registration area for identifying authorized roaming areas through which the subscriber is able to temporarily access the cellular telecommunications system;

said subscriber having means to access to said category to define the identity of said at least one authorized roaming area;

authentication means in the home registration area

for authenticating the validity of the subscriber to define the identity of said at least one authorized roaming area; and,

registration means located in the barred roaming areas for permitting said subscriber access to the cellular telecommunication system through the barred roaming area provided the barred roaming area corresponds to the authorized roaming area identified in the home area.

28. The fraud reducing system of claim 27 wherein the home registration area comprises one or more mobile areaing centers (MSCs) operated by one operator and wherein the subscriber's user profile is stored in a home location register (HLR) for the operator.

29. The fraud reducing system of claim 27 wherein authentication means includes the home area including means for designating a predetermined authorization area for the subscriber comprising one or more cells in the home area; and, means in the home area for verifying that the subscriber accesses its roaming authorization category through said authorization area.

30. The fraud reducing system of claim 27 wherein the subscriber's roaming authorization category includes a personal identification number (PIN) and the authentication means includes storage means for storing a predefined subscriber PIN and the authentication means compares the subscriber inputted PIN in the category with a predefined PIN to verify validity of the subscriber.

31. The fraud reducing system of claim 27 further including means for removing the identity of the authorized roaming area in the category upon receipt of a registration of the subscriber in its home area.

32. The fraud reducing system of claim 27 further including means for removing the identity of the authorized roaming area after a predetermined time period has expired.

33. The fraud reducing system of claim 27 further including means for removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by an operator for the home area.

34. The fraud reducing system of claim 27 further including means for removing the identity of the authorized roaming area upon receipt of a request to remove the identity of the authorized roaming area by the subscriber.

FIG.1

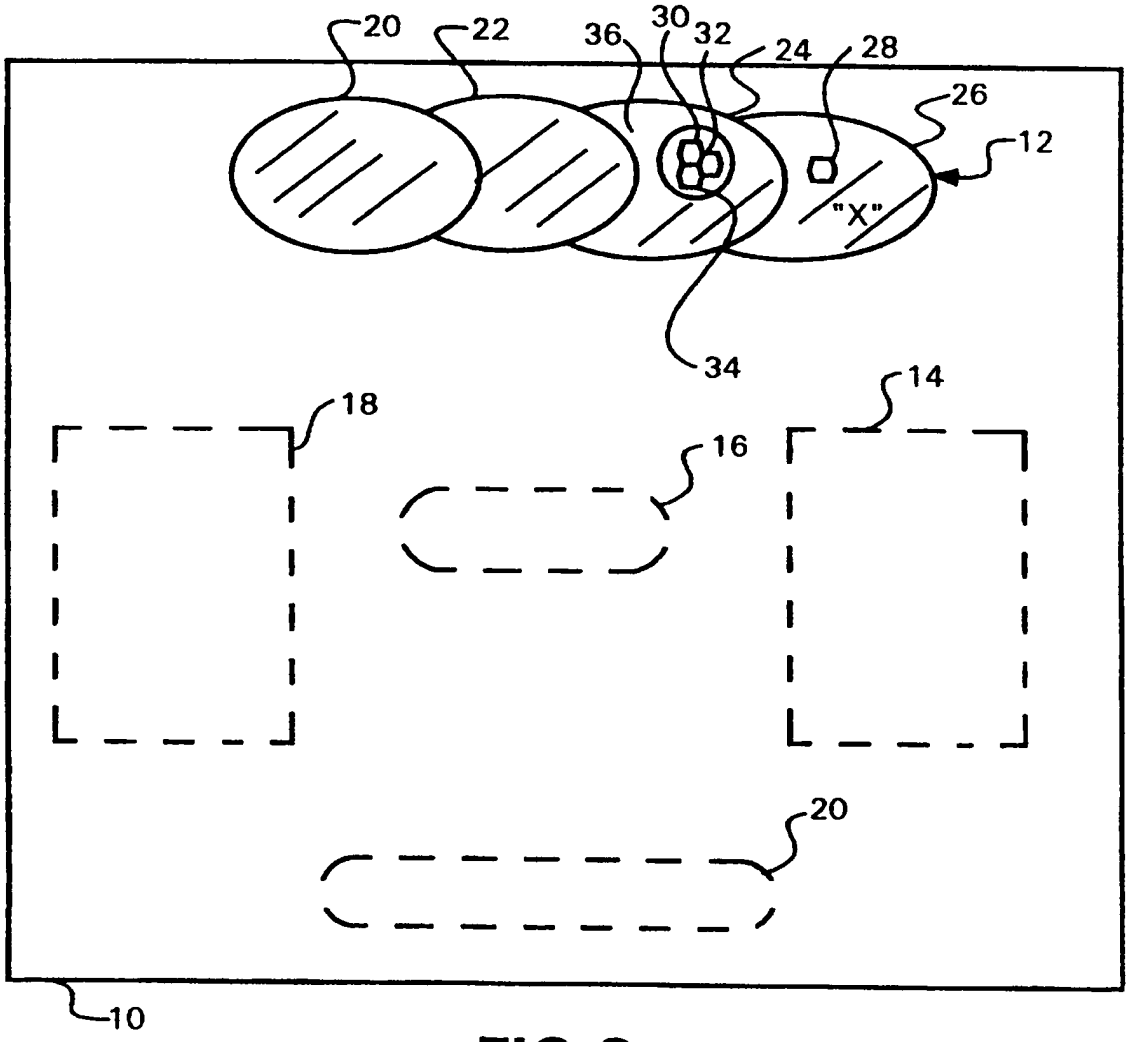

20
22
36
30
32
24
28
26
12
"X"
34
18
14
16
20
10

FIG.2

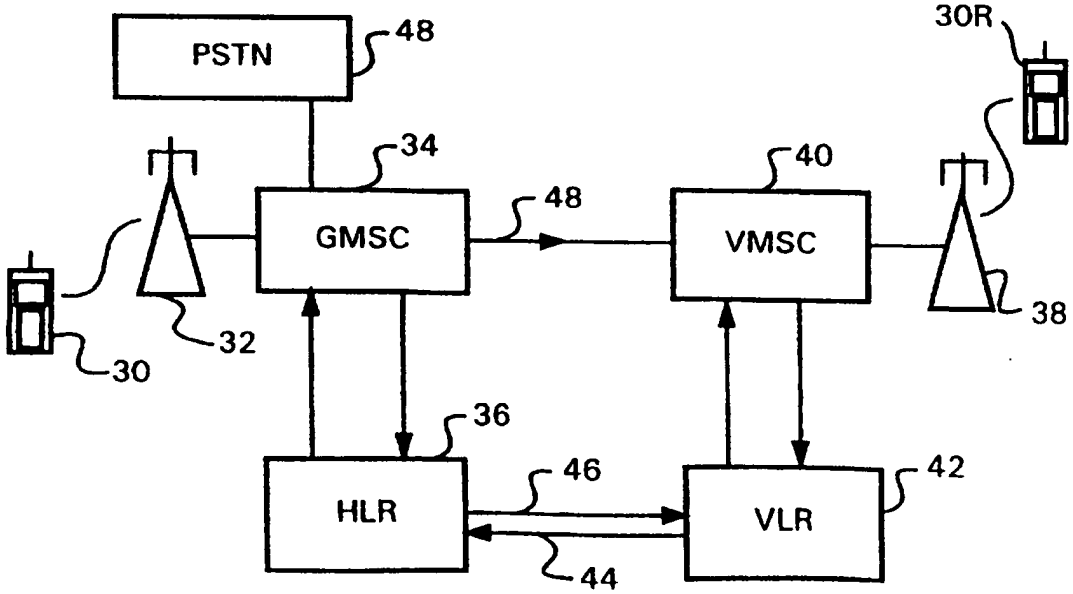

PSTN
48
30R
34
40
GMSC
48
VMSC
32
38
30
36
HLR
46
42
VLR
44

FIG.3

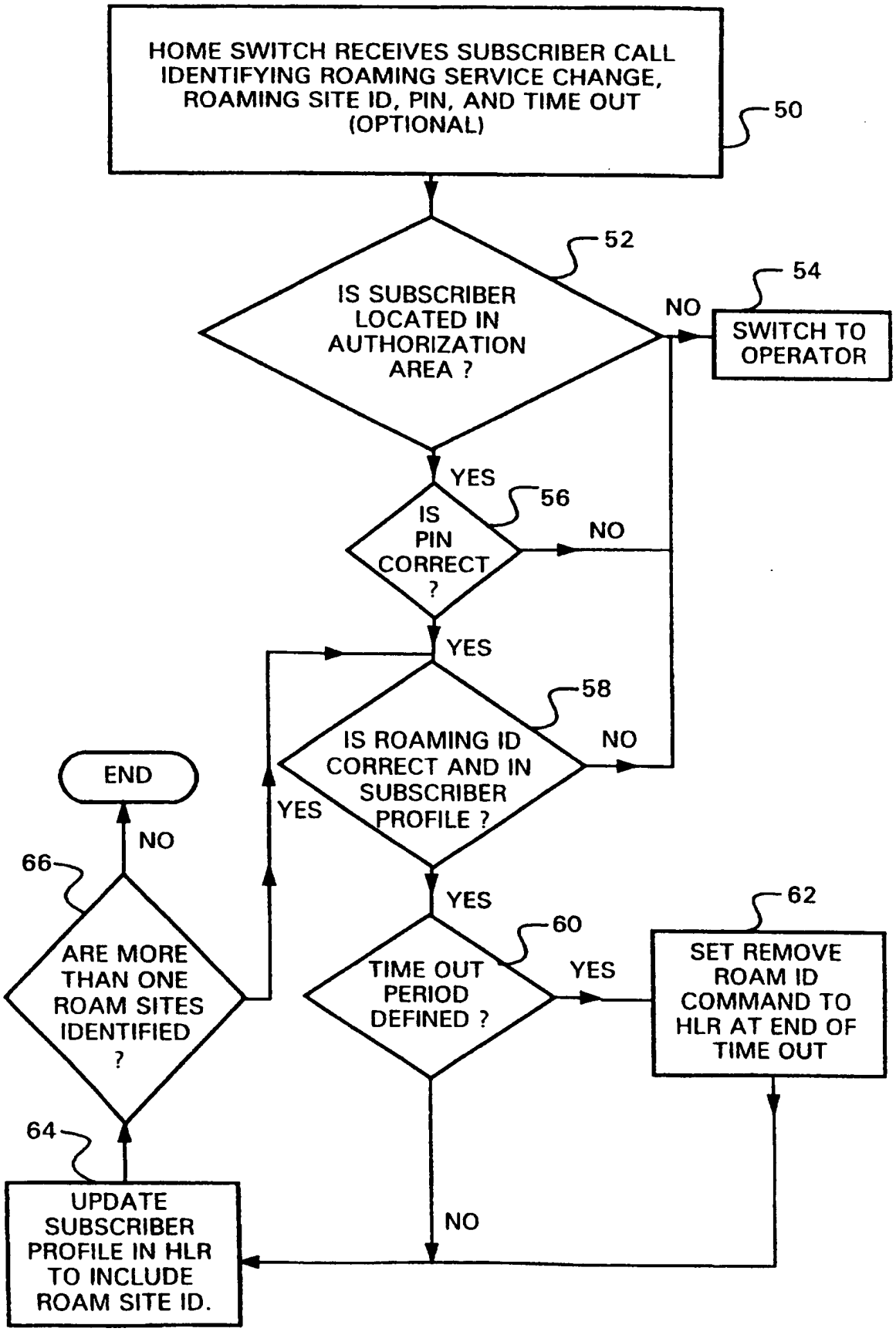

HOME SWITCH RECEIVES SUBSCRIBER CALL IDENTIFYING ROAMING SERVICE CHANGE, ROAMING SITE ID, PIN, AND TIME OUT (OPTIONAL)
50
IS SUBSCRIBER LOCATED IN AUTHORIZATION AREA ?
52
NO
SWITCH TO OPERATOR
54
YES
IS PIN CORRECT ?
56
NO
YES
IS ROAMING ID CORRECT AND IN SUBSCRIBER PROFILE ?
58
NO
YES
TIME OUT PERIOD DEFINED ?
60
YES
SET REMOVE ROAM ID COMMAND TO HLR AT END OF TIME OUT
62
NO
ARE MORE THAN ONE ROAM SITES IDENTIFIED ?
66
YES
NO
END
UPDATE SUBSCRIBER PROFILE IN HLR TO INCLUDE ROAM SITE ID.
64

FIG.4

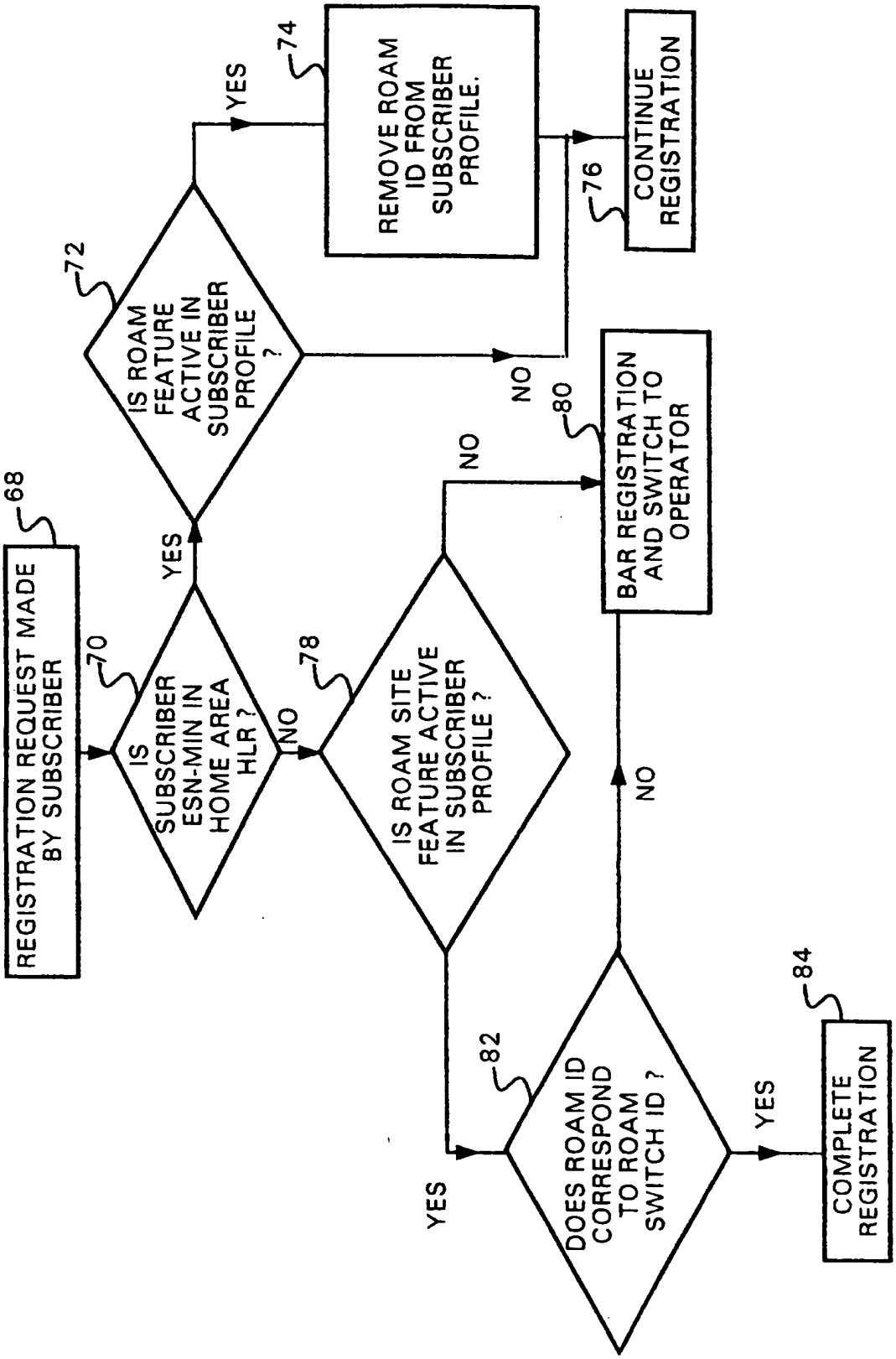

REGISTRATION REQUEST MADE BY SUBSCRIBER
68
IS SUBSCRIBER ESN-MIN IN HOME AREA HLR ?
70
YES
NO
IS ROAM FEATURE ACTIVE IN SUBSCRIBER PROFILE ?
72
YES
REMOVE ROAM ID FROM SUBSCRIBER PROFILE.
74
CONTINUE REGISTRATION
76
NO
IS ROAM SITE FEATURE ACTIVE IN SUBSCRIBER PROFILE ?
78
NO
BAR REGISTRATION AND SWITCH TO OPERATOR
80
YES
DOES ROAM ID CORRESPOND TO ROAM SWITCH ID ?
82
NO
YES
COMPLETE REGISTRATION
84

FIG.5

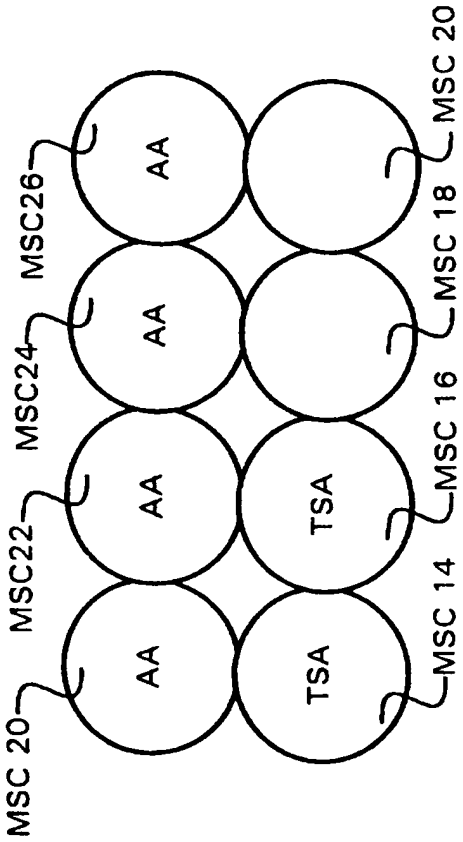
HLR SUBSCRIBER PROFILE

SUBSCRIBER "X"

.AA =MSC 20, MSC 22, MSC 24, MSC 26

.TSA = MSC 14, MSC 16

FIG.6



INTERNATIONAL SEARCH REPORT

Interna' al Application No
PCT/SE 97/00037

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 32592 A (SIEMENS AG ;REININGHAUS GEORG (AT)) 30 November 1995 see page 9, line 25 - page 12, line 12 see page 13, line 1 - page 13, line 9 see page 15, line 1 - page 16, line 8 see claim 1 ---	1,2,4,5, 7,9-12, 14, 16-20, 22,23, 25-29, 31,33,34
A	WO 93 11646 A (ELECTRONIC DATA SYSTEMS CORP) 10 June 1993 see page 12, line 14 - page 14, line 2 see page 16, line 23 - page 18, line 29 see figures 3-6 --- -/--	1,2,11, 12,19, 20,27-29

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
26 June 1997	- 4. 07. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Maalismaa, J

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INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/SE 97/00037

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GATEWAY TO NEW CONCEPTS IN VEHICULAR TECHNOLOGY, SAN FRANCISCO, MAY 1 - 3, 1989, vol. 1, 1 May 1989, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 1-6, XP000292031 KACZMAREK K W: "CELLULAR NETWORKING: A CARRIER'S PERSPECTIVE" see page 2, right-hand column, line 29 - page 3, left-hand column, line 24 -----	1,11,19

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
PCT/SE 97/00037

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9532592 A	30-11-95	DE 4417779 C	07-12-95
		EP 0760192 A	05-03-97
WO 9311646 A	10-06-93	NONE	